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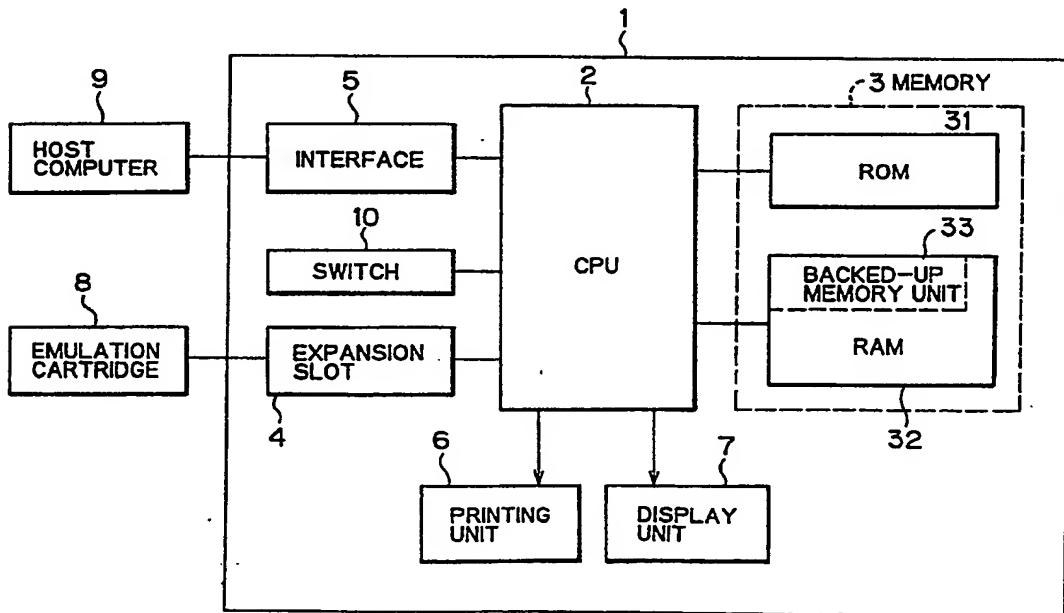
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(54) Printer having a backed-up memory for storing optional emulation program

(57) A printer has a backed-up memory unit (33) for storing an optional emulation program loaded from an emulation cartridge (8) inserted in an expansion slot (4) (or from a host computer (9)). The optional emulation program thus loaded can be used to interpret control codes relayed to the printer (1) from the host computer (9). Another emulation program is fixed in a ROM (31), the host computer selecting one for use (when both are present). The backed-up memory unit (33) may have space for plural emulation programs, with erasure of the oldest when space runs out.

FIG. 1

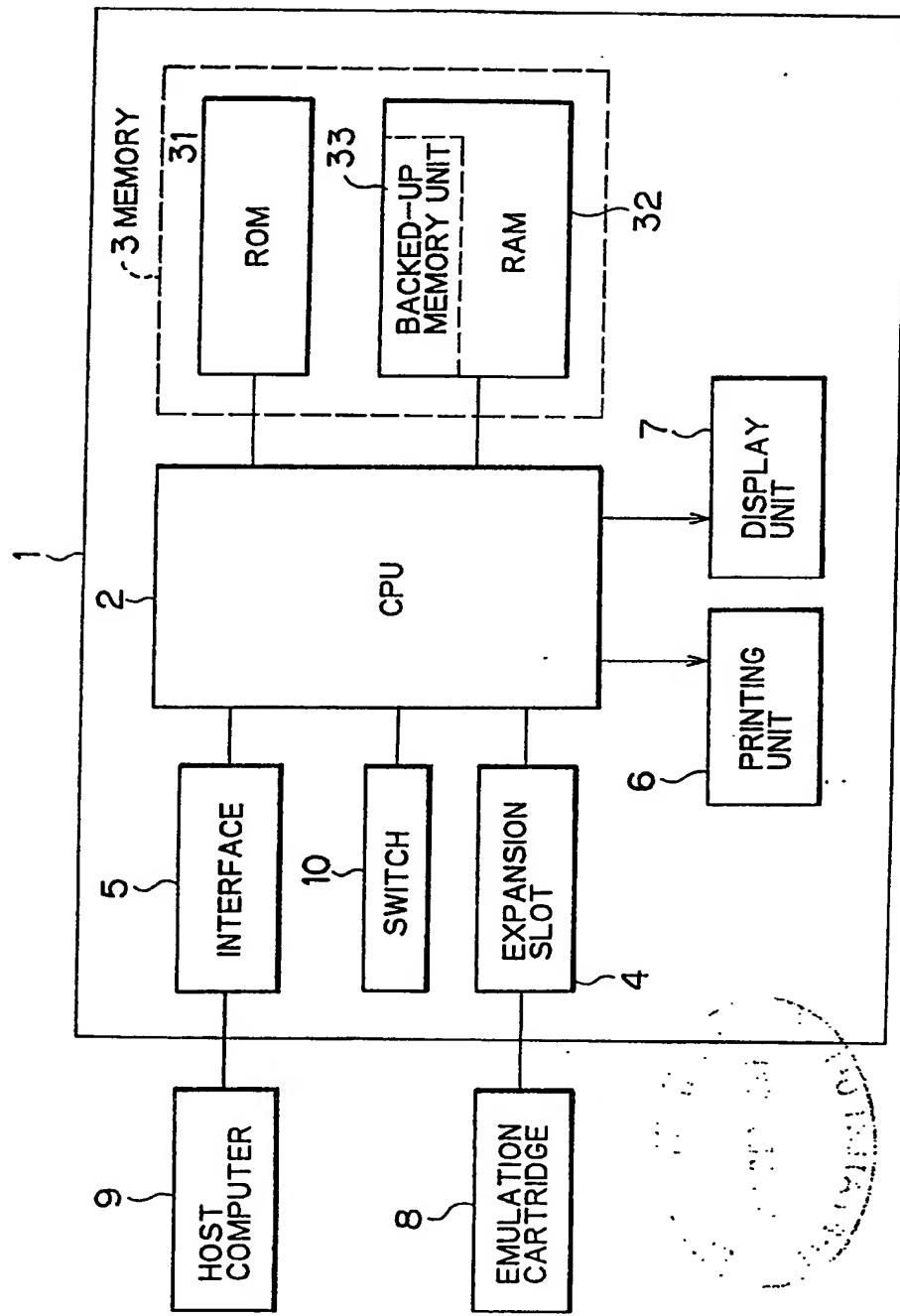


At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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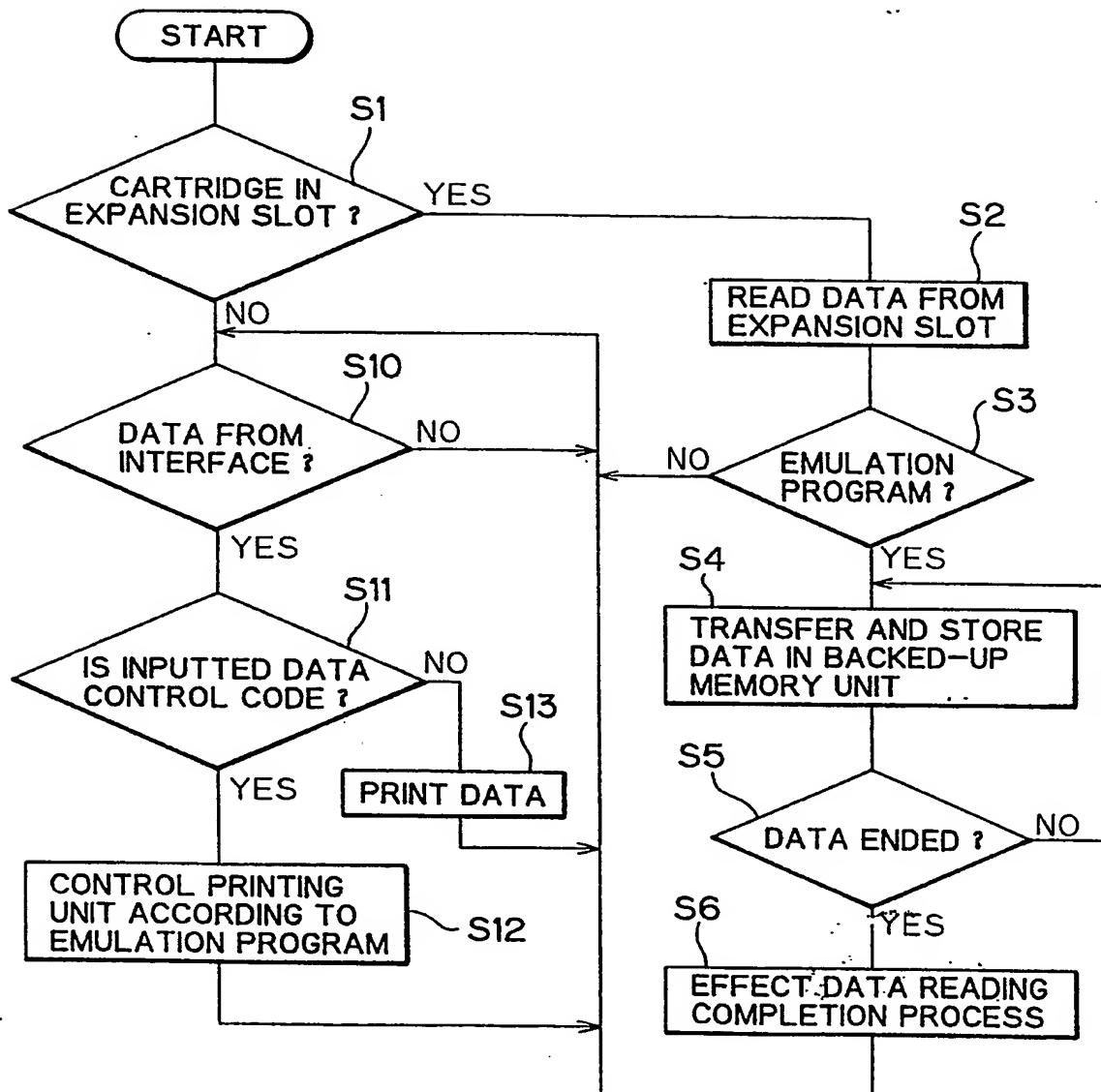
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FIG. 1

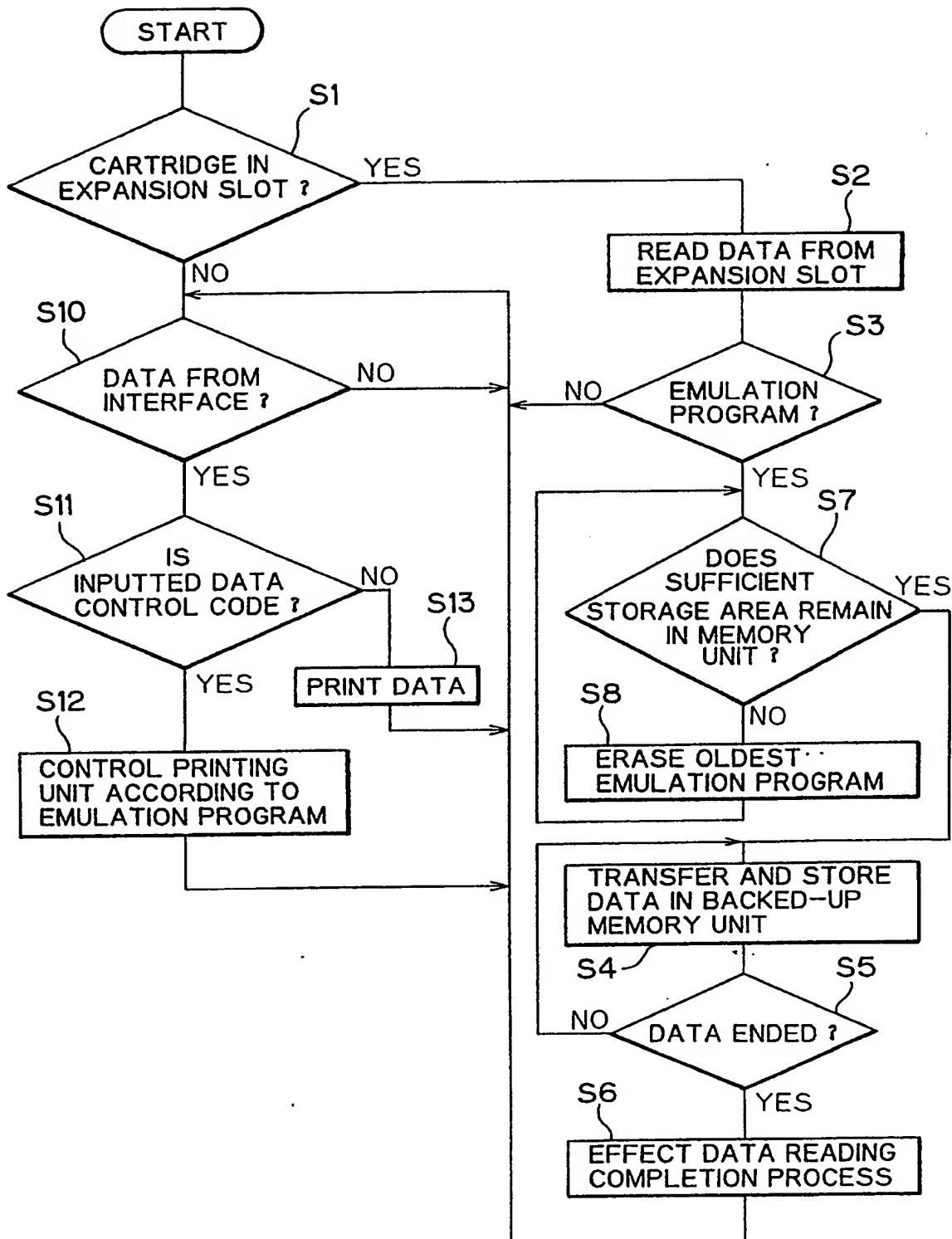


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FIG. 2



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FIG. 3



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PRINTER HAVING A BACKED-UP MEMORY
FOR STORING OPTIONAL EMULATION PROGRAM

The present invention relates to a printer such as a laser beam printer, and more particularly to an emulation program for various printers.

Printers receive control codes and print data from host computers and control printing units according to the received control codes. Printing is carried out based on the print data. In such printers, control codes are grouped into a plurality of groups, each being specific to a particular printing unit.

It is known that so-called emulation programs exist for reading the control codes that are established for a certain printer and converting the control codes into differently grouped control codes established for another printer. Such an emulation program is stored in a ROM (Read-Only Memory) incorporated in a printer, or exists in an emulation cartridge. The emulation cartridge has a ROM in the interior thereof for storing the emulation program, and is inserted into an expansion slot in the printer for use.

Where the emulation program is stored in the ROM provided in the interior of the printer, replacement of the ROM is required when the emulation program is to be updated or a new emulation program is to be added. Where the emulation program is stored in the emulation cartridge, since the emulation program in the emulation cartridge needs to be executed each time the control code is inputted, the emulation cartridge cannot be detached and therefore occupies the expansion slot during operation.

The present invention has been made in order to reduce the above problems. Accordingly, it is an object of the present invention to provide a printer which has an emulation program that can easily be modified or updated without the bulk of the emulation cartridge.

To achieve the above and other objects, there is

provided a printer for receiving control code and print data from a host computer and for controlling a print unit according to the received control code to carry out printing based on the print data, comprising:

input means for inputting an emulation program used for interpreting the control code;

first storage means for storing the emulation program that has been inputted to the input means, the storage means being backed up such that the stored emulation program is not erased when the printer is powered off; and

control means for controlling both the input means and the first storage means so that the emulation program inputted to the input means is installed in the first storage

Hence, the printer has a backed-up memory unit for storing an emulation program that is inputted such that the emulation program can easily be modified or updated and yet does not require an expansion slot or the like to be occupied.

Preferably, the printer may further comprise second storage means for storing a preselected emulation program. The emulation program stored in the first storage means and the preselected emulation program stored in the second storage means are selectively used in accordance with an identification code added to the control code received from the host computer.

The present invention will be more clearly understood from the following description, given by way of example only with reference to the accompanying drawings in which:

FIG. 1 is a block diagram showing a printer according to the present invention;

FIG. 2 is a flow chart illustrating an installation process of an emulation program according to a first embodiment of the present invention; and

FIG. 3 is a flow chart illustrating an installation process of an emulation program according to a second embodiment of the present invention.

Preferred embodiments of the present invention will 5 hereinafter be described with reference to the accompanying drawings.

Referring to FIG. 1, the printer, denoted by reference numeral 1, includes a CPU (central processing unit) 2 for effecting arithmetic and control operations, a memory 3 for storing an emulation program, an expansion slot 4 for inserting an emulation cartridge 8 therein, an interface 5 for transferring data to and from a host computer 9, a printing unit 6, a display unit 7, and a mechanical switch 10 which is turned on when an emulation cartridge 8 is inserted 10 into the expansion slot 4. The memory 3, the expansion slot 4, the interface 5, the printing unit 6, the display unit 7, and the switch 10 are connected to the CPU 2.

The memory 3 is made up of a ROM (read-only memory) 31 and a RAM (random access memory) 32, the latter having a backed-up memory unit 33 for storing the emulation program. The memory unit 33 may be electrically backed up by a battery or may be a non-volatile memory into which data can electrically be written. Therefore, the stored data in the memory unit 33 are not erased even if the printer is electrically disconnected from a power supply. The expansion slot 4 serves as an input means according to the present invention. 20 25

An operation sequence according to a first embodiment of the present invention will be described below with reference to the flow chart of FIG. 2.

First, a step S1 determines whether the cartridge 8 is inserted in the expansion slot 4 or not. The check can be performed on the basis of the state of the mechanical switch 10 which is turned on when the cartridge 8 is inserted into 30

the expansion slot 4. The switch 10 is OFF when no cartridge is in the expansion slot 4. If the cartridge 8 is inserted into the expansion slot 4, then data are read from the cartridge 8 into the CPU 2 in a step S2. The CPU 2 determines whether the read data are of an emulation program or not in a step S3. The check may be implemented on the basis of an identification code added at the head of the data relayed from the cartridge 8. The identification code identifies that the following data are of the emulation program. The identification code further identifies the kind of the emulation program.

The read data may not be the emulation program data but may be font data if, for example, a font cartridge is inserted in the expansion slot 4. If so, i.e., if the read data are not the emulation program data, then the CPU 2 waits for data from the interface 5 in a step S10. If the identification code indicates that the read data are the emulation program data, then the CPU 2 transfers the data to and stores the data in the backed-up memory unit 33 in a step S4. If a previously stored emulation program exists in the memory unit 33, a newly introduced emulation program is overwritten, so that the previously stored emulation program is erased. Therefore, there remains only a single optional emulation program in the backed-up memory unit 33.

Thereafter, the CPU 2 determines whether the data read from the cartridge 8 are ended or not in a step S5. If the data from the cartridge 8 still exist, i.e. "NO" in the step 5, then control returns to the step S4. If the data from the cartridge 8 no longer exist, i.e., "YES" in the step 5, then a data reading completion process is effected in a step S6, and then control goes to the step S10. The data reading completion process in the step S6 is for informing the user of the end of the data reading by so displaying on

the display unit 7.

Upon completion of the installation of the emulation program, the user can remove the emulation cartridge 8 from the expansion slot 4. The expansion slot 4 is now available 5 for the insertion of another cartridge such as a font cartridge, for example.

At the time control goes to the step S6, the optional emulation program stored in the backed-up memory unit 33 can be used instead of an emulation program which is originally 10 stored in the ROM 31. Specifically, if data is inputted to the CPU 2 from the interface 5 in the step S10 and the inputted data is determined as a control code in a step S11, then the printing unit 6 is controlled according to the 15 emulation program now stored in the backed-up memory unit 33 in a step 12. It should be noted that the control code is accompanied by an identification code representing the emulation program to be used. Based on the identification code, the CPU 2 determines which emulation program is to be selected upon comparing the received control code with the 20 control code attached to each of the emulation programs. However, when the optional emulation program is not installed in the backed-up memory unit 33, then the emulation program 25 stored in the ROM 31 is automatically used.

If the inputted data is not the control code in the step S11, then the inputted data are determined as print data and are subjected to printing in a step S13.

An operation sequence according to a second embodiment of the present invention will next be described with reference to the flow chart of FIG. 3. The same step numbers 30 Si (i = 1, 2, 3,...) in the flow charts of FIGS. 2 and 3 indicate the same or similar processing, therefore, duplicate description thereof is omitted. The flow chart of FIG. 3 is similar to that of FIG. 2 but is different in that steps S7

5 and S8 are newly introduced between the steps S3 and S4 so that a plurality of optional emulation programs can co-exist in the backed-up memory unit 33. To enable a plurality of optional emulation programs to be stored in the back-up memory unit 33, the capacity thereof is largely reserved.

10 Referring to the flow chart of FIG. 3, the step S7 determines whether a sufficient storage area remains in the memory unit 33 after execution in step S3. If yes, the newly introduced emulation program is not overwritten in the memory unit 33 to cause the previously written emulation programs to be erased but is insertedly stored in the memory unit 33 without erasing the existing emulation programs. If, however, there does not remain a sufficient storage area in the memory unit 33, i.e., "NO" in the step S7, then the most 15 previously written emulation program is erased in the step S8 to reserve a sufficient storage area allowing to store the new emulation program in the memory unit 33.

20 While exemplary embodiments of this invention have been described in detail, those skilled in the art will recognize that there are many possible modifications and variations which may be made in this exemplary embodiment while yet retaining many of the novel features and advantages 25 of the invention. For example, although, in the above description, the expansion slot 4 serves as the input means for inputting the emulation program, the data of the emulation program may be inputted to the backed-up memory unit 33 from the host computer 9 through the interface 5. Further, while the insertion of the cartridge 8 in the expansion slot 4 is checked by the mechanical switch 10 in the illustrated 30 embodiments, it may be checked by an electric signal generated upon insertion of the cartridge 8.

The control code and the print data relayed from the host computer 9 are typically composed of one byte but they

may be composed of 2 or 3 bytes or more than this.

According to the present invention, it is advantageous in that an emulation program stored in a memory unit in the printer can easily be updated at all times. In addition, since the expansion slot 4 is not occupied by the emulation cartridge 8 unlike the conventional printers, the expansion slot 4 is available for other cartridges such as font cartridges.

CLAIMS

1. A printer for receiving control code and print data from a host computer and for controlling a printing unit according to the received control code to carry out printing based on the print data, comprising:

input means for inputting an emulation program used for interpreting the control code;

first storage means for storing the emulation program that has been inputted to said input means, said storage means being backed up such that the stored emulation program is not erased when the printer is powered off; and

control means for controlling both said input means and said first storage means so that the emulation program inputted to said input means is installed in said first storage means.

2. A printer according to claim 1, wherein said control means installs the emulation program in said first storage means by overwriting the emulation program to cause a previously stored emulation program to be erased.

3. A printer according to claim 1, wherein said control means installs the emulation program in said first storage means by insertedly writing the emulation program to leave previously stored emulation programs unerased.

4. A printer according to claim 1, 2 or 3 further comprising second storage means for storing a preselected emulation program.

5. A printing according to claim 4, wherein the emulation program stored in said first storage means and the preselected emulation program stored in said second storage means are selectively used in accordance with an identification code added to the control code received from the host computer.

6. A printer according to claim 5, wherein each of the emulation program stored in said first storage means

and the preselected emulation program in said second storage means contains an emulation program identification code which can be specified by the identification code of the control code.

7. A printer according to any preceding claim, wherein said input means comprises an expansion slot for receiving an emulation cartridge containing the emulation program.

8. A printer according to any preceding claims, wherein said input means comprises an interface connected to an external device, said external device transmitting the emulation program to said interface.

9. A printer constructed and arranged substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

**Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)**

Application number
9124783.3

Relevant Technical fields	Search Examiner
(i) UK CI (Edition K) G4H(HGN, HQC; HQG, HPQ)	
(ii) Int CI (Edition 5) G06F	M J DAVIS
Databases (see over)	Date of Search
(i) UK Patent Office	
(ii)	31 DECEMBER 1991

Documents considered relevant following a search in respect of claims 1-9

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2220286 A (MONARCH) especially page 3 line 33 to page 4 line 2, page 8 line 27 to page 16 line 29	1-6,8



Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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